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A validation of the Strong Campbell Interest Inventory as part of the admissions process at the United States Naval Academy

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THESIS

A VALIDATION OF THE STRONG CAMPBELL INTEREST INVENTORY AS PART OF THE ADMISSIONS PROCESS AT THE UNITED STATES NAVAL ACADEMY

By

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March 2002

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The United States Naval Academy's primary focus is to produce quality leaders in the U.S. Navy and Marine Corps. As part of this effort, they believe good leaders must have the desire and ability to meet the high technical requirements of the duties of a Naval Officer. Therefore, the Academy wants applicants who exhibit not only strong academic and leadership skills, but also a strong interest in technical skills and a desire to select technical majors. The United States Naval Academy believes that using the Strong Interest Inventory (SII) will help meet this admissions goal. This research examines the use of the SII in the admissions process of the United States Naval Academy. The goal is to determine what benefits the instrument provides, specifically in predicting performance and major selection, and how to best use its results in the admissions process.

The results supported the predictive validity of the SII relative to major selection, but did not support its validity as a predictor of performance. Its inverse or neutral relationship to performance, though, supports the construct validity of the SII as an interest measure vice an academic or cognitive screening tool. The Strong Interest Inventory technical interest scale's predictive value in regard to major selection can be used to improve the U.S. Naval Academy's admissions process and help admit applicants who meet the demanding technical needs of the Navy.

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A VALIDATION OF THE STRONG CAMPBELL INTEREST INVENTORY AS PART OF THE ADMISSIONS PROCESS AT THE UNITED STATES NAVAL ACADEMY

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The United States Naval Academy's primary focus is to produce quality leaders in the U.S. Navy and Marine Corps. As part of this effort, they believe good leaders must have the desire and ability to meet the high technical requirements of the duties of a Naval Officer. Therefore, the Academy wants applicants who exhibit not only strong academic and leadership skills, but also a strong interest in technical skills and a desire to select technical majors. The United States Naval Academy believes that using the Strong Interest Inventory (SII) will help meet this admissions goal. This research examines the use of the SII in the admissions process of the United States Naval Academy. The goal is to determine what benefits the instrument provides, specifically in predicting performance and major selection, and how to best use its results in the admissions process.

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I. INTRODUCTION

A. BACKGROUND

The United States Naval Academy continually seeks admissions methods that will help them select quality students to admit into their school. The Academy seeks to provide more than academically successful graduates. Its primary focus is, rather, to produce quality leaders in the U.S. Navy and Marine Corps. Good leaders must have the desire and ability to meet the high technical requirements of the duties of a Naval Officer. To meet this goal, the Academy wants applicants who exhibit not only strong academic and leadership skills, but also a strong interest in technical skills and a desire to select technical majors. The United States Naval Academy believes that using the Strong Interest Inventory will help meet this admissions goal.

The Strong Interest Inventory (SII), formerly known as the Strong Campbell Interest Inventory (SCII), is a multiple-choice instrument designed by E.K. Strong, Jr. Originally introduced in 1927 as the Strong Vocational Interest Blanks (SVIB), it has since been revised on numerous occasions, with the latest revision being completed in 1994. Its purpose is to help individuals make career and education decisions by comparing their interests with the interests of individuals in various occupations. Matches between the respondent's interests and typical interests of workers in a specific occupation are noted and presented in a profile. This profile reports the respondent's scores on four different scales (General Occupation, Basic Interest, Occupational, and Personal Style) ranging between zero and one hundred. The higher the scale value, the higher/more similar is the interest the respondent has with workers of that occupation.

The U.S. Naval Academy uses the SII in its admissions process in a different way than the inventory was originally intended. The Academy has developed an alternate way to score the test in order to suit its own needs. Rather than break down the scoring of the test into the four different scales normally associated with the SII, the Academy has created three of its own areas: Engineering Interest (ES), Humanities Interest (HS), and Career Retention (CR). The Career Retention score varies from 1 to 1000, with 1000 being the highest likelihood of retention (a 20 year career in the Navy). The Engineering Interest and Humanities Interest score combine to equal 1000. The higher one score is, the lower the other one becomes in order to create a sum of 1000 points. The end result of the Naval Academy's manipulation is the inclusion of two of the scores, Engineering Interest and Career Retention, into the construction of the Candidate Multiple.

The Candidate Multiple is a complex numerical formula used by the Naval Academy to rank candidates for admissions. It ranges from around 14000 to 80000, with an average score of 66000 and a minimum qualifying score of 58000. The higher the score, the more qualified the applicant is in the eyes of the admissions board. The Engineering Interest score counts for 12% of the multiple and the Career Retention score counts for 3%, for a combined 15% of the Candidate Multiple being composed of results from the Strong Interest Inventory.

The Naval Academy uses its method of scoring the Strong Interest Inventory to predict whether applicants will major in technical (Group I/II) or non-technical (Group III) majors. With the Academy's strong desire to graduate midshipmen with technical majors, it continually looks for methods to identify applicants who have high technical interests. Figures constructed by the Naval Academy's Institutional Research office for

the classes of 1999 through 2001 show a high correlation between Engineering Interest and Group I/II major selection, but a more in depth study is desired.

B. OBJECTIVE

The purpose of this thesis is to reexamine the relationship between SII and both midshipmen major selection and performance indicators. The research focuses on answering the following research questions:

- Does the Strong Interest Inventory accurately predict, as USNA believes it does, from which group future midshipmen will select a major?
- Does the SII predict major selection and performance as well for minorities and women as it does for whites and men?
- Is the SII score associated with other outcomes of interest to the Admissions Board?

This thesis is not intended to be an analysis of whether the use of the SII in the admissions process is right or wrong. Rather it is intended to provide valuable information for the Admissions Board as to the predictive value of the SII in the Candidate Multiple, so it can best use the SII to meet the admissions goals of the U.S. Naval Academy.

C. SCOPE, LIMITATIONS, ASSUMPTIONS

United States Naval Academy alumni are the subjects of this research effort. Recent graduates provide data that reflect the latest admissions standards. Major selection occurs during the second half of plebe year, but often these majors change prior to graduation. By examining both the initial major selection and the major at graduation, a better understanding of the predictive nature of the variables is possible.

The data used for the analysis covers all U.S. Naval Academy alumni from the classes 1995 through 2000. This data set is limited to recent graduates because admissions criteria change over time and because of the recent concern of Naval Academy officials in the current trend of midshipmen graduating with non-technical majors.

Empirical tests will include the two binary dependent variables, technical/non-technical major at graduation and switch from technical major at graduation. A technical major is defined as either a Group I or Group II major. Non-technical majors are Group III majors. A switch in majors accounts for midshipmen who were initially in Group I or Group II, but graduated in a Group III major. Additional dependent variables such as performance in selected major will also be investigated, but to a lesser degree.

D. ORGANIZATION OF STUDY

This study is organized into five chapters. Chapter II reviews studies that relate to this research. The intent is to present a background of how and why the SII was designed and to provide a better understanding of the current methods USNA uses to select future midshipmen. Chapter III details the contents of the data set that was used for this research. A detailed explanation of the research methodologies utilized to construct the study's models is also included. Chapter IV provides the empirical results of this analysis. Chapter V summarizes the conclusions of this study and provides recommendations for policy and for further research.

II. LITERATURE REVIEW

Many colleges and universities select applicants on the basis of standardized aptitude test scores and previous academic achievement. In light of Department of Navy personnel needs and investments, the U. S. Naval Academy considers factors in addition to academic standing so that it can maximize choice of and success in major, retention, and military performance. Thus, in addition to assessing cognitive aptitude, the Naval Academy considers interest scores developed from the Strong Interest Inventory (SII). The aim of the Naval Academy in using the SII is to select a majority of students focused on technical majors. Before assessing the validity of such interest measures for USNA, the Strong Interest Inventory is described, as is the U.S. Naval Academy's modification and use of the SII to suit its unique needs.

A. THE STRONG INTEREST INVENTORY

The Strong Interest Inventory (SII) is one of the most widely used interest inventory and career counseling instruments in the U.S. (Conoley, Impara, 1994, Donnay, 1997). Formerly known as the Strong Campbell Interest Inventory (SCII), the SII is a multiple-choice instrument designed by psychometrician E.K. Strong, Jr. Originally introduced in 1927 as the Strong Vocational Interest Blanks (SVIB), it has since been revised on numerous occasions, with the latest revision being completed in 1994. Its purpose is to help individuals make career and education decisions by comparing their interests with the interests of individuals in various occupations. The overall theory behind the SII is that people will be more satisfied with a job in which they are interested (Harmon, 1994). Matches between the respondent's interests and typical interests of workers in a specific occupation are noted and presented in a profile. The SII is most

often used for college students to help identify careers they might find interesting. This is especially relevant to USNA because the test is used in its admissions process to identify candidates interested in technical careers.

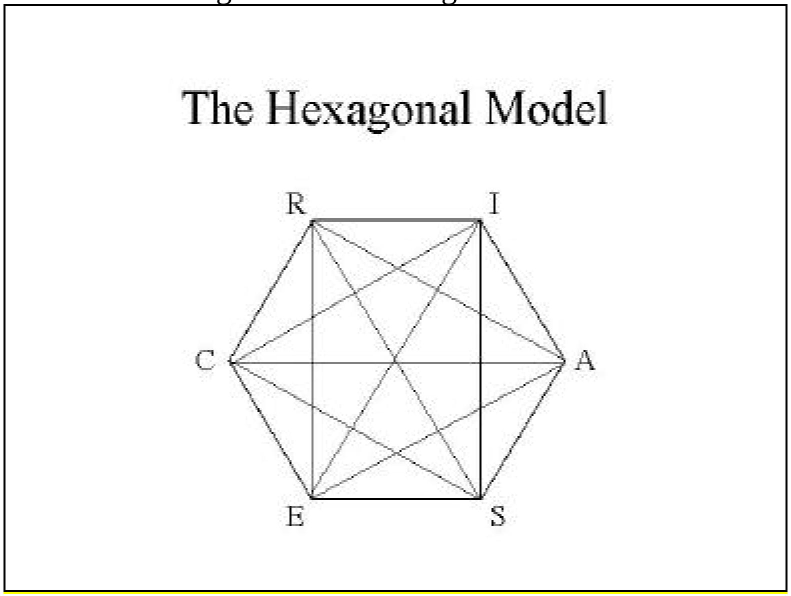
1. Strong Interest Inventory Content

The *Strong Interest Inventory: Applications and Technical Guide* (Harmon, 1994) provides an excellent review of the content, theory and application of the Strong Interest Inventory. A better understanding of the test through a review of the guide is useful prior to analyzing the SII's effectiveness in the Naval Academy admissions process.

The SII (1994 version) consists of 317 multiple-choice questions relating to the test taker's interest in occupations, activities, school subjects and types of people. The questions are designed to compare a person's pattern of responses to the patterns of different types and occupations of people. Respondents are scored on four different sets of scales: General Occupation Themes, Basic Interest, Personal Style, and Occupation. The test presents a Profile, which provides the respondent with information regarding their orientation to work, areas, occupations, learning and working styles and areas of special attention. The goal is to help the test taker to develop a strategy for making educational and career decisions.

The first of the four sets of scales is the General Occupation Themes (GOTs). The GOTs are homogeneous scales based largely on the work of John Holland. They were added to the SII in 1974 to help identify the similar types of interest between test takers and incumbents in particular occupations and are viewed to have contributed substantially to the organization and clarity of the Strong Profiles (Donnay, 1997; Campbell, 1999).

Figure 1: The Hexagonal Model



Holland categorizes people into six types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. Holland's theory assumes that individuals of similar interests will most likely work in an environment that matches those interests. He states, "the choice of a vocation is an expression of personality" (Donnay, 1996). Because a single type can hardly categorize most people, secondary and tertiary types are recognized to complete the picture of the individual. The six types are best presented and understood by looking at them in the hexagonal model. The distance between each type on the hexagon represents the correlation of the two types. Therefore, the most similar types are arranged side-by-side, whereas the least similar are directly opposite. The order of the six types around the hexagon is most easily remembered from the name of the model, RIASEC, which is derived from the first letter of each of the personality types.

Table 1 provides brief descriptions of the characteristics and interests of people associated with each of the six General Occupational Themes. Samples of jobs whose themes are typical of the scale are also provided.

Table 1. General Occupational Themes Descriptions and Sample Jobs

Scale	Description	Sample Jobs
Realistic	prefer action, like concrete ideas	police officers, plumbers, auto mechanics
Investigative	self-reliant, like to work with ideas	chemists, physicians
Artistic	independent, impulsive and intuitive	lawyers, musicians, reporters
Social	friendly, understanding and ethical	child care providers, elementary school teachers
Enterprising	highly aggressive, social and adventuresome	realtors, life insurance agents
Conventional	practical, systematic, careful and precise	bookkeepers, clerical workers, accountants

The Basic Interest Scales (BIS) are the other 25 homogeneous (based on factor analysis) scales used in the SII. They provide more specific interest content. They serve as subdivisions of the General Occupation Themes and are provided in the Profile under their related General Occupation Theme. Table 2 charts the Basic Interests Scales and their related General Occupation Themes.

Table 2. Basic Interest Scales and Related General Occupation Themes

	General Occupation Themes					
	Realistic	**Investigative**	**Artistic**	**Social**	**Enterprising**	**Conventional**
Basic Interest Scales	Agriculture	Science	Music/ Dramatics	Teaching	Public Speaking	Data Management
	Nature	Mathematics	Art	Social Service	Law/Politics	Computer Activities
	Military Activities	Medical Science	Applied Arts	Medical Service	Merchandising	Office Services
	Athletics		Writing	Religious Activities	Sales	
	Mechanical Activities		Culinary Arts		Organizational Management	

The Personal Style Scales are the newest addition to the SII. They are designed to measure the broad preference of living and working styles and help describe an individual's comfort in different environments. It is important to note that they merely

show interest rather than success in specific environments. They include four scales: work style, learning environment, leadership style, and risk taking/adventure. The anchors of each scale have distinct meanings. The work style scale provides information on what the individual prefers to work with: people or ideas.[1] The learning environment scale was developed to help differentiate between individuals who prefer either practical or academic environments. The leadership style scale relates whether a person likes to direct others or lead by example. The risk taking scale of the SII attempts to predict the likelihood of the individual taking risks and being spontaneous. Table 3 shows the two ends of each scale and lists typical jobs associated with each.

Table 3. Personal Style Scales Descriptions and Sample Jobs

Scale	**Description**	**Sample Jobs**
Work Style	work with people	childcare providers, flight attendants, social workers
	work with ideas	chemists, mathematicians, physicists
Learning Environment	academic environment	lawyers, physicists
	practical learning	plumbers, farmers
Leadership Style	direct others	elected public officials, public administrators
	lead by example	chemists, physicists, mathematicians
Risk Taking/ Adventure	high risk	emergency medical technicians, police officers.
	low risk	librarians, mathematicians

[1] The work style scales work well with the previously mentioned RIASEC scales from the Holland model. They provide an axis across the Hexagonal Model, thereby linking the Enterprising and Social themes together (works with people) and the Realistic and Investigative themes (works with ideas).

The fourth and final of the SII scales are the Occupational Scales (OS). They were the original scales developed by E.K. Strong. There are 211 Occupational scales, 102 pairs of scales (separate scales for males and females) and 7 single gender scales. Each scale represents satisfied workers employed in that specific occupation. The scales were designed to enable a test taker to compare his/her interests with those typical of people employed in the various occupations. When working with younger people, especially high school and early college students, it is particularly helpful to examine OS scores in the context of GOTs and BISs.

2. Development of the SII Scales

To create the Strong Interest Inventory Scales, a general reference sample (GRS) was needed from which to interpret resulting SII scores. The 1994 normative base was constructed by administering the test to approximately 55,000 individuals in 98 occupations. Individuals had to meet four requirements: be at least 25 years old, have at least three years of experience, perform activities typical of their occupation, and describe themselves as satisfied with their occupation. From the remaining members in each of the 98 occupations, 200 individuals were randomly selected (100 female and 100 male) to represent the group. In occupations with less than 200 respondents, the entire group was used. The result was a reference sample containing 9467 women and 9484 men (18951 total) (Harmon, 1994).

The scales were developed by one of two methods. The first method was purely statistical. After factor analyzing the data set, items that loaded together (i.e., people responded to similarly) and differentiated between occupations comprised a scale. Separate scales were also created for men and women. The GOTs, BISs, and two of the

Personal Style Scales (Leadership Style and Risk Taking/Adventure) were developed using this method.

The second method identified items that differentiated members of a particular group from members at large. The Occupational Scales and the Work Style and Learning Environment from the Personal Style Scales were constructed using this method.

Each of the four sets of scales was also standardized to a mean value of 50 and a standard deviation of 10. The formula used to standardize the scales is:

$$\text{Standard score} = \left(\frac{X - Mc}{SDc}\right) 10 + 50$$

X= individual's raw score

Mc= combined GRS raw score mean

SDc= combined GRS raw score standard deviation

Standardization facilitates comparison of scores among scales. For example, a score of 70 on the Agriculture scale and 70 on the Religious Activities scale means the respondent likes both to the same relative degree.

3. Validation of the SII Scales

The SII has been validated numerous times and judged a good predictor of vocational choice (Harmon, 1994). The reliability and validity of the test have been praised, as have the presentation and interpretiveness of the information the test provides (Conoley & Impara, 1994). Busch further compliments the continuous efforts to evaluate and revise the SII. Recent validation studies have shown that the SII is able to predict the occupation of a respondent from a field of 50 occupations with 24.5% accuracy (or correct classification) (Donnay, 1996). A random answer would only occur 2% of the

time. Therefore, based on discriminate analysis, the test is more than twelve times as likely to predict occupation correctly. If the criterion is between science and non-science fields, the prediction is correct 72.5% of the time. The SII seems to be a valid measure for predicting occupational choice.

Donnay and Borgen (1996) provide a validation of the most recent SII. The purpose of their study was to quantify the 1994 SII's ability to predict occupational group membership. Their study showed that all 35 of the (GOS, BIS, Work Styles) non-occupational scales significantly distinguished among incumbents of various occupations. The basic interest scales were shown to be the most valid predictors of occupational group membership. This is probably influenced by the basic interest scales' ability to handle the complexity of a multivariate space better than the personal style scales and general occupational themes. The latter scale sets work better in a two-dimensional space. Although two dimensions are clearly salient and useful in summarizing interest, more dimensions increase the predictive value. Also, of particular note was the ability of the personal style scales to contribute to the prediction, since it highlights the ability of personality measures to contribute to a prediction model.

A study perhaps more relevant to the Naval Academy was done at the University of Denver and involved male Air Force officers (Redmond, 1987). The study assessed the ability of the SII to differentiate between University of Denver Air Force ROTC and "regular" University of Denver students based on interests. Redmond compared ROTC students to the general sample and University of Denver students on the basis of two SII scales: the Air Force Officer Occupational Scale and Military Activities Scale (BIS).

Further, Air Force officers' (not ROTC students) scores on the Air Force Occupational Scale and the occupational scale that best fit their job specialty code were compared.

Results indicated that Air Force ROTC students did in fact score the same or higher on the Air Force Officer scale than both the general sample and University of Denver students. Additionally, the Air Force Officers' service in the Air Force was rooted in their desire to be an Air Force officer more than in their desire to serve in a particular specialty as evidenced by their higher scores on the Air Force Officer Occupational Scale than on the occupational scale that best fit their actual job.[2]

Despite the success of the SII, some concerns as to the construction and administration of the test have been noted. Published response rates for the SII are lacking (Conoley & Impara, 1994). This has led to speculation of a low rate of return with only a small slice of the broad spectrum of people in each occupation and concomitant concerns over the adequacy of the norms. This may not provide a representative sample of each occupation. Even though validations and alterations of the use of the SII have been made with entire classes rather than samples of the classes, the use of entire classes doesn't eliminate concerns about applicant representativeness. Another prevalent criticism and one evident in the Naval Academy's use of the SII, has been the non-standardized conditions in which the tests were administered to the sample groups. While some test takers took the test in a controlled environment, others administered it to themselves at home. The concern is that some individuals may have received more information about typical responses that may have influenced their scoring

[2] Additional validations of the SII in the military are addressed later when validating the Academy's use of the SII in admissions.

(Conoley & Impara, 1994). This concern is echoed below in this study's recommendations to the USNA Admissions Board.

Despite the criticisms of the reviewers, the common agreement has been that the SII is the best available interest inventory (Conoley & Impara, 1994). Overall, the Strong has been judged as a valid, structurally sound, and comprehensive measure of career satisfaction. It has validity for determining interest in careers and, in the Academy's use, academic majors.

B. THE USNA VERSION OF THE SII

The Academy has a strong desire to graduate midshipmen with technical majors (e.g., engineering and science). Toward this end, it has sought methods to identify applicants who have high technical interests. Considering the promise, popularity, and technical properties of the SII, the Naval Academy adapted this instrument to fulfill its unique needs. SII scores are used to predict whether applicants will major in technical (Group I/II) or non-technical (Group III) majors. Below, the history of USNA's use and adaptation of the SII is presented followed by a brief discussion on the modifications made to the SII, and a validation of the USNA SII scales.

1. History of SII at USNA

The Naval Academy first considered using the SII in 1967 (then known as the Strong Vocational Interest Blank) as a tool to predict attrition during the summer session just prior to beginning the first academic year.[3] The test was administered "as is" to the applicants and the results were investigated using the SVIB norms. At that time, the SII

[3] All students admitted into the Naval Academy must attend a six-week course during the summer referred to as Plebe Summer.

was judged to be unproductive and invasive (McNitt, 1982). Interest in the SII resurfaced in 1975 when the Navy decided that the Academy should require midshipmen to select majors in an 80/20 percent split between technical majors and non-technical majors. With this new requirement, the Navy Personnel Research and Development Center (NPRDC) was tasked with developing scoring keys for the SVIB that would predict major, military performance, voluntary resignation and total four year attrition. The SVIB was administered to the classes of 1975 through 1978 (Bearden, 2001; McNitt, 1982).[4] By comparing the major selection and retention of these USNA classes with their original SVIB answers, NPRDC succeeded in creating a Candidate Multiple that included Math and Verbal SATs, rank in class, two teacher recommendations, athletic and non-athletic Extra Curricular Activities (ECAs) and the newly created SVIB derivatives: Engineering Science (ESR) and Disenrollment (DISR). ESR was used to predict technical major selection and DISR was used to predict voluntary resignation and four year attrition. The Academic Board approved the use of the Candidate Multiple in 1975 for the class of 1980 (McNitt, 1982).

[4] The SII was known as the SVIB until 1974.

Table 4. Candidate Multiple Predictive Weights

	Class of 1980	**Class of 2005**
Verbal SAT	11	15
Math SAT	34	31
High School Class Rank	18	21
Teacher Recommends	12	8
Extracurricular Activities	2	10
Engineering Science (Technical Interest Score)	9	12
Disenrollment (Career Interest Score)	14	3

(Pantelides, 2001)

The SVIB derivatives were new scales created by NPRDC using previous Academy classes as the norm. Despite the inclusion of two SII-like scales in the multiple, it was noted that only one was valid. ESR was validated at between .30 and .40, for predicting major (technical vs. humanities). DISR, on the other hand, was adopted despite its poor validity coefficient for predicting disenrollment (.09) and military performance (.10, which it was never intended to predict) because it was deemed better than no such predictor (McNitt, 1982). The initial weights used for the Candidate Multiple are displayed in Table 4. Despite the validation of ESR and the lack of confidence in DISR, the two scores initially accounted for 9% and 14% of the multiple, respectively. In the late 1980s, the scales were renamed Engineering and Science (E/S) and Career Retention (CR). Once again, E/S was used to help predict students who would major in technical fields. Career Retention, though, had the added task of trying to predict whether an applicant might make the Navy a career.[5] Along with the change in

[5] Unfortunately, the ability of the CR/CIS to predict a 20-year career cannot as yet be validated since none of the applicants who received a CR/CIS score have reached 20 years of service.

names came an increase in weights, with highs of 16% and 19% respectively. Rear Admiral C.R. Larson (USNA Superintendent at the time) commented about the Academy's confidence in the CR and its decision to increase the weight in 1984 (Larson, 1984). In recent years, though, the two scores, now known as Technical Interest (TIS) and Career Interest (CIS), have had their weights shifted by the serving Superintendents to reflect the current values of the administrations.

2. How USNA Modified the SII

In light of Navy needs and investments, the SII has been adapted for use by the Admissions Department of the Naval Academy. Rather than using the four sets of scales comprising the published SII, the Academy has created two of its own scales: Technical Interest (TIS) and Career Interest (CIS). The Career Interest and Technical Interest scores have been rescaled to a range between 1 and 1000 with a mean of approximately 500 (499.74 and 497.18, respectively) and a standard deviation of 97.40 and 94.65. A CIS score of 1000 represents the highest likelihood of retention (a 20 year career in the Navy). A TIS score of 1000 represents the highest likelihood of selecting a technical major. For the classes of 1995 thru 2000 the actual (in contrast to the theoretical) TIS score range was between 204 and 747, and the CIS score range was between 123 and 794. On average, a student with a higher TIS score is more likely to declare a technical major, while a higher CIS score is more likely to have a 20-year Navy career.

To yield more relevant scores, the Academy developed a unique scoring key based on the results of regression analysis between past classes' SII scores and both choice of major and retention (Bearden, 2001). Original (unadapted) SII results were analyzed to select items most predictive of major selection and career retention. When

these questions were identified, a key was constructed which either added or subtracted a point for specific answers. The applicants take the entire SII, but the test is scored based only on the selected answers. A sample question asks how you feel about doing work as a Mechanical Engineer. A like (L) would be scored as plus one (+1). Answers of Indifferent (I) or Dislike (D) would have a zero weight. USNA's Technical Interest scale includes 55 questions from the pool of 325 SII questions from the 1984 version (Pantelides, 2001).

3. Validation of the USNA SII Scales

As noted above, recent validation studies (for example, Donnay 1996) suggest that the SII is a valid measure for predicting occupational choice. The Naval Academy's use of its own scoring system also shows merit in distinguishing between students majoring in technical and non-technical majors. As far back as 1984, NPRDC validated each of the components of the Candidate Multiple. The Engineering Science Scale (now the TIS) had a validity coefficient of between .40 and .44 for predicting choice of major (Admissions Office, 1984; Bearden, 1999; McNitt, 1982). Recent data from the classes of 1994 to 1996 also show that midshipman majoring in technical areas tend to score higher on technical interests. Group I and II majors have mean scores of 526 and 514, respectively. Group III majors have a mean of only 445. Additional research by the Naval Academy's Institutional Research Center shows a high correlation between technical interest and Group I/II major selection. These results seem to validate the Academy's continued use of the SII in the Candidate Multiple (Gottschalk, 2001).

Several issues arise when looking at the overall value of using the SII in USNA admissions. A primary concern, especially in an environment where diversity is valued,

is using a weight that may lean away from the admission of women and minorities. When looking at the admissions data of the classes 1995 to 2000, it becomes apparent that women and blacks tend to score lower on technical interest. The mean technical interest score for women was 449.45. This is more than 50 points lower than the mean score for male applicants (504.57). A gap also exists for blacks, though rather small. Black applicants had a mean score of 495.05, compared to a mean score of 498.06 for whites. The disparity of the scores, though, is in line with performance on the criterion: more females and blacks tend to graduate with Group III majors than the general midshipman population consisting mainly of white males (Gottschalk, 2000; 2001).

The other issue that arises is using an admissions element that may predict a major, but has no predictive value of the performance of individuals who select that major. Although it is more likely that an individual who scores 700 vice 300 on the technical interest scale will select a technical major, there is no increased prediction of the scorer performing better (Bowman & Mehay, 1999). The mean QPR for those who score low on technical interest is no lower than those who score higher. The Director of the Engineering Division at the Naval Academy questions the value of a score that merely predicts interest rather than performance (Rubel, 2001).

C. CONCLUSION

There is evidence that the use of the SII in the Candidate Multiple provides predictive value when it comes to major selection. The data analysis section investigates the validity of the SII variables in the six most recent graduation classes. Unfortunately, as used currently, concerns exist regarding whether the Candidate Multiple may work against diversity goals while working towards its goal of producing more graduates with

technical majors. In an effort to assess the SII's validity for gender and racial groups, the midshipman sample is split by race and gender thereby permitting subgroup validity estimation. In addition to predicting technical major, the value of the SII for predicting performance is explored. Three prime measurements of midshipmen performance are analyzed to determine the performance prediction value of the SII variables. The goal is to provide analyses that may lead to recommendations for the admissions process that work for all the groups concerned.

III. DATA AND METHODOLOGY

This chapter provides an explanation of the regression analyses undertaken to validate the SII as an admissions tool. First, the data set used to construct the regression model is reviewed. Next, the specific variables included in the analyses are defined. Finally, the methodology used to examine the relationship between the SII and both major selection and primary performance indicators is described. These relationships were modeled using binary logit and linear analyses of different model specifications.

A. DATA

The data used to conduct the regression analysis in this thesis were obtained from the U. S. Naval Academy Office of Institutional Research, Planning, and Assessment (IR).[6] The data cover all the applicants admitted into the classes of 1995 thru 2000-- the six most recent graduating classes of the Naval Academy. This initial group of 7129 admitted students was filtered to exclude students with incomplete admission data and to create a working database of midshipmen who had values for each of the five dependent variables. The resulting database contains 5418 graduates of the midshipmen in the six classes.

The variables shown in Table 5 were selected because of their role in the candidate multiple and perceived effect on major selection and performance.

[6] Institutional Research was founded in 1992 to maintain, evaluate, and provide institutional data to help advance the admissions and education processes at the Academy. Its staff of five full-time employees maintains information on both midshipmen and graduate performance and is the point of contact for data collection and information regarding personnel at the Academy. The Institutional Research Department is also charged with assessing, monitoring and maintaining the USNA Strategic Plan.

Table 5. Components of the Major Selection and Performance Indicator Models

COMPONENTS OF THE CANDIDATE MULTIPLE: - High Math SAT - High Verbal SAT - Recommendations of High School Officials - Standardized Combined ECA Score - Standardized High School Class Rank - Career Interest Score (SII derivative) - Technical Interest Score (SII derivative) **ADDITIONAL FACTORS PERCEIVED TO AFFECT MAJOR SELECTION AND PERFORMANCE:** - Gender - Ethnic Background

The models constructed for this research used the seven core factors of the candidate multiple along with ethnic and gender specifications. This allowed a validation of these factors in determining major selection and performance, while accounting for possible differences by race and gender. The aim is to provide future guidance in the use of the Strong Interest Inventory derived variables to maximize the predictive value of admissions selection.

B. VARIABLES

This section discusses in detail the dependent and independent variables used in the "major selection" model. The general descriptive values, hypothesized effects, prediction weights and reasons for their inclusion are provided in each variable description.

1. Dependent Variables

The dependent variables are broken into two areas: those focusing on major selection and those that represent performance indicators. Major selection is the primary

focus of the validation and both initial and final major selections were considered. The inclusion of performance indicators in the model allows a partial assessment of other potential benefits of including the SII in the admissions formula besides choice of major. The performance indicators are represented by military and academic quality point ratings and final rank in class. These are the three main performance indicators used at the Academy.[7]

a) Initial Major Selection

Initial major selection is that which a student selected at the end of the freshman year. It is a dichotomous variable with a value of 1 if the individual selected a technical major (Group I/II) as the first major selection and 0 if the individual's initial major selection was non-technical (Group III). It is important to distinguish between midshipmen whose initial interests guide them toward a technical major and those who actually graduate with a technical degree. Since the purpose of including this variable is to examine how well the technical interest score predicts technical major selection, midshipmen who change majors, but remain in a technical field are not distinguished.[8] It is the belief of many (Gottschalk, Pantelides, & Rubel, 2001) that the SII predicts initial major selection better than final major selection. It is thought that some midshipmen opt out of the rigorous demands of technical majors after completing a semester or two of study. One's primary interest ("technical" course of study) may be eschewed in favor of concentrating on merely graduating.

[7] USNA Instruction 1531.51A and Academic Dean and Provost Instruction 1531.60 provide definitions of the components of the performance indicators.

[8] Change is technically not measured, rather major selection at two points in time: initially and at graduation.

b) Final Major Selection

Final major selection is the area in which the student earned a degree upon graduation from the Naval Academy. It is a dichotomous variable with a value of 1 if the individual selected a technical major (Group I/II) as the final major and 0 if the individual's final major was non-technical (Group III). Final major selection is what the Admissions Board seeks to predict with the SII. Although initial major selection taps the initial interest of midshipmen, the hope is that technical interests will influence a midshipman to persevere in a technical major.

c) Order of Merit

Order of merit is the final ranking of midshipmen at graduation. The Order of Merit for a class is computed by weighting performance in five areas. The Naval Academy Superintendent determines these areas and their weights. The multiple for each factor in Table 6 is obtained by multiplying the weight for that factor by the semester quality point ratio (SQPR) or by the mark or the numerical value of the letter grade. The Semester Multiple is the sum of the multiples assigned for a given semester. The Aggregate Multiple is the sum of the Semester Multiples to date. Order of Merit is then based on the Aggregate Multiple. The midshipman with the highest Aggregate Multiple is ranked number one. Admiral Larson changed the formula for the Order of Merit Calculation in the spring of 1996. The Professional Competency Review (PCR) Examination was removed and its weight was distributed among the other factors.[9]

[9] The PCR tested the cumulative professional (military) knowledge of the students. It was administered at the end of each class year.

Tables 6 and 7 provide the Pre-Spring 1996 and Post-Fall 1995 calculation formulas (U.S. Naval Academy, 1994; 1995).

Table 6. Order of Merit Calculation Matrix (Pre-Spring 1996)

	4/C year[10] Semester		**3/C year Semester**		**2/C year Semester**		**1/C year Semester**			
Factor	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**Total**	**Percent**
Academic and Professional Courses	31	31	31	31	31	31	31	31	248	64.82
Physical Education	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	25.6	6.69
Athletic Performance		3		3		3		4	13	3.40
Professional Competency Review Examination		4		4		4		4	16	4.18
Military Performance	7	7	7	7	7	7	7	7	56	14.64
Conduct	3	3	3	3	3	3	3	3	24	6.27
TOTAL									382.6	100.00

(U.S. Naval Academy, 1994)

Table 7. Order of Merit Calculation Matrix (Post-Fall 1995)

	4/C year Semester		**3/C year Semester**		**2/C year Semester**		**1/C year Semester**			
Factor	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**Total**	**Percent**
Academic and Professional Courses	31	31	31	31	31	31	31	31	248	64.48
Physical Education	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	25.6	6.66
Athletic Performance		3		3		3		4	13	3.38
Military Performance	7	7	8	8	9	9	10	10	68	17.68
Conduct	3	3	3.5	3.5	4	4	4.5	4.5	30	7.80
TOTAL									384.6	100.00

(U.S. Naval Academy, 1995)

With the exception of "athletic performance," the values for the factors are calculated from the numerical value of the course grades earned. Athletic performance is based on the level of participation for the year. Varsity and club sport members receive

[10] Freshman, sophomore, junior and senior year are referred to at USNA as 4/C year, 3/C year. 2/C year, and 1/C year, respectively.

between 2 and 4 points, whereas junior varsity and intramural participants receive 1 point. Midshipmen who do not participate in a sport receive 0 points.[11]

An example helps clarify how the calculations work. A midshipman in his second semester of 2/C year (1999) with a 3.2 SQPR, an A in Physical Education, an A in Athletic Performance, a B in Military Performance, and a B in Conduct would have a Semester Multiple of 163.0. He would be ranked above (receive a lower Order of Merit number) another midshipmen of the same class who received a 2.2 SQPR, a B in Physical Education, a B in Athletic Performance, an A in Military Performance, and an A in Conduct (Semester Multiple of 134.8), if their Aggregate Multiples were equal the previous semester.

As stated earlier, order of merit is the final ranking received by Naval Academy graduates. It has a direct effect on service assignments and duty stations initially received after graduation. It also determines their rank order for the first few years in the fleet, until promotions separate the higher performers. This fact makes order of merit the primary performance indicator at the Academy and necessitates its inclusion in this study.

d) Academic QPR

Academic quality point rating is the average grade received by the midshipmen in all of his/her academic and professional courses. It is calculated using the formula:

$$\frac{\text{Total quality point value}}{\text{Total semester credit hours}} = \text{AQPR}$$

[11] Additional points are added to the academic weights for students with over 19 credit hours, honors courses, and graduate work.

The quality point value of each factor of each the letter grade is:

A = 4   B = 3   C = 2   D = 1   F = 0

The score ranges from 0 to 4, with 4 being the highest and 0 the lowest QPR. The QPR is typically displayed to two decimal places. The Academic QPR for the six classes included in this research ranged between 1.92 and 4.00, with a mean value of 2.92 and a standard deviation of .47.

Academic QPR is the most important component of the Order of Merit. As seen in Tables 5 and 6, it accounts for 64.48% of a midshipman's final standing. Its high value in the order of merit as well as its implications in later graduate education admissions makes it suitable as a separate performance criterion.

e) Military QPR

Military quality point rating is the average grade received by the midshipmen in all of his/her professional/military courses, conduct, military performance and physical education. The Cumulative MQPR includes all professional endeavors prior to graduation at the Naval Academy. It is used to report how each midshipman is performing militarily (OOM contains all the parts of MQPR, but at different weights). The calculation of this score was also changed in the spring of 1996. The weight of the PCR was distributed among Military Performance and Conduct. It is calculated using the formula:

$$\frac{\text{Total quality point value}}{\text{Total professional coefficients}} = \text{MQPR}$$

As with Academic QPR, the score ranges from 0 to 4, with 4 being the highest and 0 the lowest QPR. It is typically displayed to two decimal places. The

Military QPR for the six classes ranged between 2.08 and 3.99, with a mean value of 3.20 and a standard deviation of .31.

Table 8. Military Quality Points Calculation Matrix (Pre-Spring 1995)

	4/C year Semester		3/C year Semester		2/C year Semester		1/C year Semester			
Factor	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**Total**	**Percent**
Physical Education	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	25.6	17.00
Athletic Performance		3		3		3		4	13	8.63
Military Performance	7	7	7	7	7	7	7	7	56	37.19
Conduct	3	3	3	3	3	3	3	3	24	15.94
Professional Competency Review Examination		4		4		4		4	16	10.62
Professional Courses	2	2	2	2	2	2	2	2	16	10.62
TOTAL									150.6	100.00

(U.S. Naval Academy, 1994)

Table 9. Military Quality Points Calculation Matrix (Post-Fall 1995)

	4/C year Semester		3/C year Semester		2/C year Semester		1/C year Semester			
Factor	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**Total**	**Percent**
Physical Education	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	25.6	16.78
Athletic Performance		3		3		3		4	13	8.52
Military Performance	7	7	8	8	9	9	10	10	68	44.56
Conduct	3	3	3.5	3.5	4	4	4.5	4.5	30	19.66
Professional Courses	2	2	2	2	2	2	2	2	16	10.48
TOTAL									150.6	100.00

(U.S. Naval Academy, 1995)

Again, an example will help understand how this score is calculated. A midshipman in his second semester of his 1/C year (Post-Fall 1995) who received an A in Physical Education, a B in Athletic Performance, an A in both Military Performance and Conduct, and a B in his Professional Course would have a calculated MQPR of 3.75 (Total Quality Points of 88.8 divided by Professional Coefficients of 23.7).

2. Independent Variables

The explanatory variables consist mainly of the seven weights used to calculate the candidate multiple for each applicant. They are high math SAT, high verbal SAT,

high school official recommendations, combined ECA score, high school class rank, technical interest and career interest scores. The seven variables represent the core of the admissions process, thus their inclusion in the model is essential in validating the unique benefits of the SII scores. Also of particular note is the inclusion of gender and ethnic variables. The value of these variables in the model is also discussed below. Table 10 provides the Predictive Weights given the variables in the Candidate Multiple. Table 11 provides the minimum, maximum, mean value, and standard deviation of the independent variables.

Table 10. Independent Variable Predictive Weights

Variable	**Predictive Weight**
High Math SAT	31
High Verbal SAT	15
High School Class Rank	21
Recommendations	8
ECAs	10
SII Technical Interest	12
SII Career Interest	3

Table 11. Independent Variable Description Table

VARIABLE	**MINIMUM**	**MAXIMUM**	**MEAN VALUE**	**STD DEVIATION**
High Math SAT	400	805	661.88	60.93
High Verbal SAT	200	805	577.89	76.05
HS Class Rank	300	800	578.63	106.59
Recommendations	409	999	877.83	85.49
Combined ECA	300	800	556.91	68.99
Career Interest	123	794	499.74	97.40
Technical Interest	204	747	497.18	94.65

a) High Math SAT (SATM_HI)

The high math SAT is fairly straightforward in its description. It is the high math score received by the applicant on the SAT. If the student took the ACT instead, the score represents the converted ACT score. The SAT has been a core admissions tool for many colleges and universities and performs similarly at the Naval Academy. Its predictive weight of 31 accounts for more of the candidate multiple than any other variable. The high Math SAT of the graduates of the classes 1995 through 2000 ranged between 400 and 805 (math and verbal SAT scores of 805 are possible due to the ACT conversion), with a mean score of 661.88 and a standard deviation of 60.93.

b) High Verbal SAT (SATV_HI)

The high verbal SAT is parallel to the previously mentioned high math SAT. It is the highest verbal score received by the applicant on his/her verbal portion of the SAT (or converted ACT score). Its predictive weight in the candidate multiple is 15, making it the third highest weight. The high verbal SAT score for the graduates ranged between 200 and 805, with a mean score of 577.89 and a standard deviation of 76.05.

c) High School Class Rank (HS_RANK)

The high school class rank represents the applicant's final rank in his/her high school class upon graduation. It has been converted to a standard score in order to function as a better comparison between applicants who graduated from different size high schools. Its predictive weight in the candidate multiple is 21, making it the second most heavily weighted predictor. The High School class rank ranged between 300 and 800 for the graduates, with a mean score of 578.63 and a standard deviation of 106.59.

d) Recommendations (RECOM)

Recommendations are the combined scores of two recommendations written for the applicant. The student must have a mathematics teacher and an English teacher submit recommendations. The admissions department assigns a standard score for each recommendation received and then takes the average to calculate the recommendations score. The combined recommendation score has a predictive weight of 8, making it the 6th highest weight. Recommendation scores ranged between 409 and 999, with a mean score of 877.83 and a standard deviation of 85.49.

e) ECAs (COMB_ECA)

The extracurricular activities score is a combined score used to show the applicants involvement in both athletic and non-athletic activities prior to applying to USNA. Similar to recommendations, the admissions department assigns a standard score for each ECA and then takes the average. The result is the combined ECA score. The combined ECA score has a predictive weight of 10, making it the 5th highest weight. The combined ECA scores of the graduates ranged between 300 and 800, with a mean score of 556.91 and a standard deviation of 68.99.

f) SII Technical Interest (TIS_STD)

The Strong Interest Inventory technical interest score is the first of the two SII used in the admissions process and is the primary interest of this validation. As described previously, it predicts likelihood of the applicant majoring in a technical field. Of the 5418 graduates, the technical interest score ranged between 204 and 747, with a mean score of 497.18 and a standard deviation of 94.65.

g) SII Career Interest (CIS_STD)

The Strong Interest Inventory career interest score is the second of the two SII used in the admissions process. It is used to predict likelihood of the applicant making the Navy a career (20 years). The career interest score for the classes ranged between 123 and 794, with a mean score of 499.74 and a standard deviation of 97.40.

h) Race (BLACK)

Race is categorized as non-black or black with values of 0 and 1 respectively. This variable is included to assess whether major selection tendencies among blacks are similar to whites. It is a common perception that blacks tend to migrate toward non-technical majors. Although many blacks initially may select technical majors, a large percentage graduate with non-technical majors (Gottschalk, 2001).

Table 12. Ethnic Background Frequency Statistics

VARIABLE	CASES	PERCENT	CUMULATIVE PERCENT
WHITE	4489	82.9	82.9
BLACK	315	5.8	88.7
OTHER MINORITY	614	11.3	100.0

i) Gender (FEMALE)

The gender variable is coded as male (0) and female (1). This variable is included to try to determine if major selection tendencies among the sexes are similar. As with blacks, it is a common perception that women tend to select non-technical majors. Unlike blacks, though, women typically maintain the same major from start to finish (Gottschalk, 2001).

Table 13. Gender Frequency Statistics

VARIABLE	CASES	PERCENT	CUMULATIVE PERCENT
FEMALE	726	13.4	13.4
MALE	4692	86.6	100.0

C. METHODOLOGY

The purpose of this analysis is to determine empirically if the SII is effective in determining major selection for midshipmen at the Naval Academy. This section of the chapter describes the specifications of the major selection and performance models. The three major selection models use binomial logit analysis in keeping with the dichotomous nature of the dependent variables -- initial major (init_maj) and final major (fin_maj). A separate model was run for females alone. Further, a separate model also was fit to black, male midshipmen. These models are detailed in Table 14.

Table 14. Major Selection Models

Baseline Logit Major Selection Model:

INIT_MAJ = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD)

FIN_MAJ = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD)

Female Logit Major Selection Model:

INIT_MAJ = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD)

FIN_MAJ = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD,)

Black Logit Major Selection Model:

INIT_MAJ = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD)

FIN_MAJ = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD)

The performance indicator models use continuous variables as their dependent variables. This necessitates using a linear model as opposed to a binomial logit model as discussed with the major selection models. These basic models are detailed in Table 15.

Table 15. Performance Indicator Linear Models

Cumulative Academic Quality Point Rating Linear Model:

CUM_AQPR = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD, BLACK, FEMALE)

Cumulative Military Quality Point Rating Linear Model:

CUM_MQPR = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD, BLACK, FEMALE)

Order of Merit Linear Model:

OOM = f (SATM_HI, SATV_HI, RECOM, COMB_ECA, CIS_STD, TIS_STD, HS_STD, BLACK, FEMALE)

The six models discussed in this section were constructed to assess the admissions model in terms of the effectiveness of using the Strong Interest Inventory and other factors for selecting midshipmen who will major in a technical field and perform successfully.

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IV. ANALYSIS

This chapter reports on the use of logit and linear regression analysis to predict technical major selection and performance among Midshipmen at the Naval Academy, respectively, on the basis of the seven core variables of the candidate multiple, gender, and racial group. The results for each model are presented in tables throughout this chapter. Reported logit results include the coefficient, standard deviation, significance and classification results, along with a calculated marginal effect. The marginal effects are similar to odds ratios and represent the effect of a change in the independent variable on the probability of major selection (initial and final). This is necessary because the binary logit coefficients do not reveal the impact of a small change in each independent variable on the dichotomous dependent variable.

Comparable statistics are provided for the linear regression results: unstandardized coefficient, standardized coefficient (Beta weight), standard deviation and significance. The linear regression on cumulative academic QPR includes data from all six classes. The regressions on order of merit and cumulative military QPR were done for each class. This is necessary because of changes in order of merit and military QPR calculations in response to the removal of the Professional Competency Review Tests in the spring semester of 1996.

A. BASELINE MAJOR SELECTION MODEL

Tables 16 and 17 display the results of the logit model for predicting initial and final major selection, respectively. In this first model, six of the seven independent

variables were significant (at the .001 level) in predicting initial major selection. The only variable not significant is high school officials' recommendations.[12]

Table 16 shows that math SAT scores, high school class rank, SII career interest and SII technical interest are positively related to technical major selection. Although the marginal effects for each of these variables have small values, they represent an increase in probability of selection of a technical major for every point value. The low values for the four independent variables are partly attributable to the wide ranges (i.e., between 123 and 805 points).

The marginal effect of math SAT indicates that for each point higher on the math SAT increased the probability of an initial technical major by .0016. Likewise, standardized high school class rank and SII career interest both increased the probability of selecting a technical major by .0006 and .0004, respectively. The strongest factor in predicting initial technical major selection was SII technical interest. Each point on the technical interest scale increased the probability by .0018. This amounts to an increased probability of .33 for a student scoring one standard deviation above the mean (591.83) relative to a student scoring one standard deviation below the mean (402.53).

Two of the independent variables in Model 1 showed an inverse relationship with the initial selection of a technical major. For each point scored on the verbal portion of the SAT, the probability of selecting a technical major decreased by .0006. Similarly, each point a student receives on the combined ECA reduces the likelihood of initial

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[12] The independent variable "recommendations" is not significant at the .05 level in any of the logit models.

technical major selection by .0004. As mentioned previously, these apparently small marginal effect values are attributable to the wide ranges of the variables. An overall correct prediction of 74.6% shows that the model was a fairly successful predictor.

Table 16. Initial Major Selection Model Results

VARIABLE	MARGINAL EFFECT	LOGIT COEFFICIENT	STANDARD ERROR	SIGNIFICANCE LEVEL
HIGH MATH SAT	0.0016	.008	.001	.000
HIGH VERBAL SAT	-0.0006	-.003	.000	.000
HIGH SCHOOL CLASS RANK	0.0006	.003	.000	.000
COMBINED ECA	-0.0004	-.002	.000	.000
RECOMMENDATIONS	0.0001	.001	.000	.098
SII CAREER INTEREST	0.0004	.002	.000	.000
SII TECHNICAL INTEREST	0.0018	.009	.000	.000
CONSTANT	-1.9184	-9.527	.635	.000
CHI SQUARE:	1237.049	**-2 LOG LIKELIHOOD:**	5577.004	**SAMPLE SIZE:** 5418
		PREDICTED INITIAL MAJOR		**PERCENTAGE CORRECT**
OBSERVED		**NON-TECHNICAL MAJOR**	**TECHNICAL MAJOR**	
INITIAL MAJOR	**NON-TECHNICAL MAJOR**	784	964	44.9
	TECHNICAL MAJOR	413	3257	88.7
OVERALL PERCENTAGE				74.6

1. The critical value for determining classification as correct is .500.

Table 17 represents the results of the second half of the Model 1 logit, focusing on the marginal effect of the seven independent variables on final major selection. Similar to the Table 16 results, six of the seven variables were significant (in the same direction) in predicting final major selection. Additionally, standardized high school class rank and SII career interest had the same marginal effects, .0006 and .0004, respectively. High math SAT and SII technical interest were more predictive of final major than initial major. Although SII technical interest had a greater marginal effect on final major selection (.0019), high math SAT (.0020) had the largest positive marginal effect for

predicting final major selection. The negative variables also had an increased effect. Both high verbal SAT and combined ECA, had a greater negative effect on final major selection. Although this model does predict 72.9% of the major selections, it is not as accurate a predictor of final major selection as it was of the initial major selection.

Table 17. Final Major Selection Model Results

VARIABLE	MARGINAL EFFECT	LOGIT COEFFICIENT	STANDARD ERROR	SIGNIFICANCE LEVEL
HIGH MATH SAT	0.0020	0.009	.001	.000
HIGH VERBAL SAT	-0.0007	-0.003	.000	.000
HIGH SCHOOL CLASS RANK	0.0006	0.003	.000	.000
COMBINED ECA	-0.0005	-0.002	.000	.000
RECOMMENDATIONS	0.0002	0.001	.000	.086
SII CAREER INTEREST	0.0004	0.002	.000	.000
SII TECHNICAL INTEREST	0.0019	0.009	.000	.000
CONSTANT	-2.1865	-9.750	.619	.000
CHI SQUARE:	1297.519	**-2 LOG LIKELIHOOD:**	5854.894	**SAMPLE SIZE:** 5418
		PREDICTED FINAL MAJOR		**PERCENT AGE CORRECT**
OBSERVED		**NON-TECHNICAL MAJOR**	**TECHNICAL MAJOR**	
FINAL MAJOR	**NON-TECHNICAL MAJOR**	1058	958	52.5
	TECHNICAL MAJOR	508	2894	85.1
OVERALL PERCENTAGE				72.9

B. GENDER-SPECIFIC MAJOR SELECTION MODEL

Table 18 shows the results of estimating initial major selection using the seven core variables for female midshipmen only. Since 86.6% of the midshipmen at the Naval Academy are male, the baseline model is sufficient in representing the male estimates of major selection. In this model, five of the seven variables were statistically significant (at the .05 level or better) in terms of predicting initial major selection. Based on this model, each point received on the female applicant's high math SAT, standardized high school

class rank, SII career interest and SII technical interest contributed to an increase in technical major selection probability. The computed marginal effect for these four variables increased (with some effects nearly doubling) from model 1 with values of .0021, .0011, .0008, and .0022.

Only one statistically significant variable was inversely related to initial technical major selection. This variable was high verbal SAT. Each point received in this factor reduced the probability of selecting a technical major initially by .0013. The effect was stronger for female midshipmen alone than for the total sample. The model overall was 73.6% effective in predicting initial major selection.

Table 18. Initial Major Selection Model Results: Female Specific Model

VARIABLE	**MARGINAL EFFECT**	**LOGIT COEFFICIENT**	**STANDARD ERROR**	**SIGNIFICANCE LEVEL**
HIGH MATH SAT	0.0021	.010	.002	.000
HIGH VERBAL SAT	-0.0013	-.006	.001	.000
HIGH SCHOOL CLASS RANK	0.0011	.005	.001	.000
COMBINED ECA	0.0000	.000	.001	.966
RECOMMENDATIONS	-0.0006	-.003	.001	.059
SII CAREER INTEREST	0.0008	.003	.001	.000
SII TECHNICAL INTEREST	0.0022	.010	.001	.000
CONSTANT	-1.9570	-8.914	1.900	.000
CHI SQUARE:	214.558	**-2 LOG LIKELIHOOD:**	742.650	SAMPLE **SIZE:** 726
		PREDICTED INITIAL MAJOR		**PERCENTAGE CORRECT**
OBSERVED		**NON-TECHNICAL MAJOR**	**TECHNICAL MAJOR**	
INITIAL MAJOR	**NON-TECHNICAL MAJOR**	148	121	55.0
	TECHNICAL MAJOR	71	386	84.5
OVERALL PERCENTAGE				73.6

Table 19 presents the results of the major selection model for final major selection, specific to female midshipmen. Once again, five of the seven independent variables were statistically significant and had similar associations (positive or negative)

with final technical major selection. Three of the variables, high math SAT, high school class rank and SII technical interest, were more predictive of final than initial major. High verbal SAT and SII career interest were less effective in predicting the probability of a final technical major. The selection model specific to female midshipmen correctly predicted 74.0% of the cases.

Table 19. Final Major Selection Model Results: Female Specific Model

VARIABLE	**MARGINAL EFFECT**	**LOGIT COEFFICIENT**	**STANDARD ERROR**	**SIGNIFICANCE LEVEL**
HIGH MATH SAT	0.0027	.011	.002	.000
HIGH VERBAL SAT	-0.0009	-.004	.001	.007
HIGH SCHOOL CLASS RANK	0.0012	.005	.001	.000
COMBINED ECA	0.0000	.000	.001	.934
RECOMMENDATIONS	-0.0006	-.003	.001	.058
SII CAREER INTEREST	0.0006	.002	.001	.010
SII TECHNICAL INTEREST	0.0026	.011	.001	.000
CONSTANT	-2.7189	-11.250	1.912	.000
CHI SQUARE:	234.358	**-2 LOG LIKELIHOOD:**	759.360	**SAMPLE SIZE:** 726
		PREDICTED FINAL MAJOR		**PERCENTAGE CORRECT**
OBSERVED		**NON-TECHNICAL MAJOR**	**TECHNICAL MAJOR**	
FINAL MAJOR	**NON-TECHNICAL MAJOR**	204	111	64.8
	TECHNICAL MAJOR	78	333	81.0
OVERALL PERCENTAGE				74.0

C. RACE-SPECIFIC MAJOR SELECTION MODEL

As with gender, race-specific models were run to assess whether the effects of the selection factors held for the minority. Table 20 shows the results of running the base model with only black, male midshipmen. The regression resulted in only two of seven variables reaching a statistically significant level for predicting initial major. High math SAT and SII technical interest were the only variables that showed any significant effect.

Both showed a higher positive effect on predicting initial major selection than in model 1. The initial major selection model for black male midshipmen was successful at predicting major selection 75.8%.

Table 20. Initial Major Selection Model Results: Black, Male Specific Model

VARIABLE	MARGINAL EFFECT	LOGIT COEFFICIENT	STANDARD ERROR	SIGNIFICANCE LEVEL
HIGH MATH SAT	0.0020	0.009	.003	.000
HIGH VERBAL SAT	-0.0005	-0.002	.002	.337
HIGH SCHOOL CLASS RANK	0.0000	0.000	.002	.996
COMBINED ECA	-0.0009	-0.004	.002	.067
RECOMMENDATIONS	-0.0002	-0.001	.002	.649
SII CAREER INTEREST	0.0006	0.003	.002	.070
SII TECHNICAL INTEREST	0.0020	0.010	.002	.000
CONSTANT	-1.4277	-6.675	3.010	.027
CHI SQUARE:	66.692	**-2 LOG LIKELIHOOD:**	275.517	**SAMPLE SIZE:** 265
		PREDICTED INITIAL MAJOR		**PERCENTAGE CORRECT**
OBSERVED		**NON-TECHNICAL MAJOR**	**TECHNICAL MAJOR**	
INITIAL MAJOR	**NON-TECHNICAL MAJOR**	48	44	52.2
	TECHNICAL MAJOR	20	153	88.4
OVERALL PERCENTAGE				75.8

As for initial major, the model for final major selection showed that only high math SAT and SII technical were significant (at the .05 level). The final selection model for black male midshipmen was not as effective in predicting major selection as the initial major selection model.

Table 21. Final Major Selection Model Results: Black, Male Specific Model

VARIABLE	MARGINAL EFFECT	LOGIT COEFFICIENT	STANDARD ERROR	SIGNIFICANCE LEVEL
HIGH MATH SAT	0.0018	0.008	.002	.001
HIGH VERBAL SAT	-0.0006	-0.003	.002	.206
HIGH SCHOOL CLASS RANK	0.0002	0.001	.001	.590
COMBINED ECA	-0.0008	-0.004	.002	.083
RECOMMENDATIONS	0.0002	0.001	.002	.644
SII CAREER INTEREST	0.0001	0.001	.001	.687
SII TECHNICAL INTEREST	0.0018	0.008	.002	.000
CONSTANT	-1.4033	-6.561	2.814	.020
CHI SQUARE:	52.805	**-2 LOG LIKELIHOOD:**	305.450	**SAMPLE SIZE:** 265
		PREDICTED FINAL MAJOR		**PERCENTAGE CORRECT**
OBSERVED		**NON-TECHNICAL MAJOR**	**TECHNICAL MAJOR**	
FINAL MAJOR	**NON-TECHNICAL MAJOR**	60	48	55.6
	TECHNICAL MAJOR	26	131	83.4
OVERALL PERCENTAGE				72.1

D. LINEAR REGRESSION MODEL OF ACADEMIC QUALITY POINT RATING

In addition to studying the effect of the SII on major selection, its secondary effect on performance indicators is examined. Model 4 investigates the relationship between Academic Quality Point Rating and the seven core admissions factors. Since separate regressions for females and black males resulted in insignificant coefficient values for SII technical interest and SII career interest, gender and race are included as independent variables in the models.[13]

[13] The female regression for AQPR was significant for SII technical interest, but had nearly the same coefficient value as for the overall data set.

Of the ten independent variables, nine proved to be statistically significant at the .05-level. The one exception was SII career interest.[14]. Table 22 displays the significant factors that predict the academic quality point rating. High math SAT, high verbal SAT, high school class rank, and recommendations all have positive effects on Academic QPR. Every point received in these areas increases a midshipman's predicted AQPR by anywhere between .0003 (recommendations) and .0021 (high math SAT) points. High school class rank and high math SAT had the largest effects on predictions with standardized coefficient values of .343 and .266, respectively. Combined ECA, SII technical interest, female (with male as the reference), black, and other race (with white as the reference) all are negatively related to AQPR. Based on the coefficients, Blacks and other races have a predicted AQPR .1631 and .1060 lower than whites. Likewise, females are predicted to have a .0578 lower AQPR than males in this model. Another interesting note is the negative values of the combined ECA and SII technical interest coefficients. Although the smallest values of the six significant core variables, they still can result in a predicted AQPR as much as .32 (combined ECA) and .22 (SII technical interest) lower. The AQPR model as a whole explained over one-third the total variability of the AQPR.[15]

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[14] This is the first model where the variable "recommendations" is significant.

[15] The Adjusted R-squared value for the model was .340.

Table 22. Cumulative Academic QPR Linear Regression Model Results

VARIABLE	UNSTANDARDIZED COEFFICIENT	STANDARDIZED COEFFICIENT	STANDARD ERROR	t STAT	SIGNIFICANCE LEVEL
HIGH MATH SAT	0.0021	0.266	0.000	0.236	0.000
HIGH VERBAL SAT	0.0006	0.099	0.000	7.768	0.000
HIGH SCHOOL CLASS RANK	0.0015	0.343	0.000	27.330	0.000
COMBINED ECA	-0.0004	-0.058	0.000	-4.999	0.000
RECOMMENDATIONS	0.0003	0.054	0.000	4.661	0.000
SII CAREER INTEREST	0.0001	0.014	0.000	1.239	0.215
SII TECHNICAL INTEREST	-0.0003	-0.065	0.000	-5.378	0.000
FOR GENDER: MALE = REFERENCE CATEGORY					
FEMALE	-0.0578	-0.042	0.016	-3.639	0.000
FOR RACE/ETHNICITY: WHITE = REFERENCE CATEGORY					
BLACK	-0.1631	-0.081	0.024	-6.931	0.000
OTHER MINORITY	-0.1060	-0.071	0.017	-6.318	0.000
CONSTANT	0.4417		0.101	4.388	0.000
R-SQUARED:	0.342		**ADJ R-SQUARED:**	0.340	**F-STATISTIC:** 280.534

E. LINEAR REGRESSION MODEL OF MILITARY QUALITY POINT RATING

Table 23 displays the variables from the linear regression model predicting Military Quality Point Rating. For this model, six separate regressions were run, one for each class year, to account for the different formulas used to calculate Military Quality Point Rating among the six classes in the database. The removal of the Professional Competency Review Tests in the spring semester of 1996 resulted in a new formula.

Overall, 8 of the 10 independent variables were significant for at least one of the classes at the .05 or better level in the MQPR model.[16] All five of the remaining independent core admissions variables were associated with a higher predicted Military QPR, with high math SAT and high school class rank being the only two significant for every class.[17] The coefficient values ranged between a low of .00030 (high verbal SAT, 1995) to a high of .00090 (high school class rank, 1999). Once again, each point scored in these six core variables was associated with an increase in the student's predicted MQPR. After standardizing the coefficients, it became apparent that high school class rank had the largest effect on predicting military QPR for each of the classes.[18]

The variables representing demographics all showed negative effects for MQPR. The variable "female" was significant for the classes 1995, 1998, and 2000, coefficient ranging from .056 to .098 (average of the significant weights = -.078). It had a similar strength of effect on MQPR as combined ECA.[19] The race variables also showed significant negative effects on MQPR. The "black" variable was significant for all six classes with an average negative coefficient value of .146. The "other" variable was significant for every class except 1999 and had an average negative coefficient value of .096. The MQPR model as a whole explained on average 19.3% of the total variability of the MQPR.

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[16] SII career interest and SII technical interest were not significant for any of the classes.

[17] "Recommendations" were significant for every class except 1999.

[18] See Table 23.

[19] See the standardized coefficient values in Table 23.

Table 23. Cumulative Military QPR Linear Regression Model Results
(Unstandardized Coefficients)

VARIABLE	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**AVG SIGNIFICANT VALUES**
HIGH MATH SAT	**0.00056**	**0.00071**	**0.00046**	**0.00056**	**0.00063**	**0.00074**	**0.00061**
HIGH VERBAL SAT	**0.00030**	0.00011	**0.00041**	0.00027	0.00027	0.00004	**0.00053**
HIGH SCHOOL CLASS RANK	**0.00072**	**0.00073**	**0.00053**	**0.00067**	**0.00090**	**0.00076**	**0.00072**
COMBINED ECA	0.00014	0.00018	**0.00031**	0.00004	**0.00037**	**0.00036**	**0.00035**
RECOMMENDATIONS	**0.00034**	**0.00035**	**0.00031**	**0.00032**	0.00019	**0.00035**	**0.00033**
SII CAREER INTEREST	0.00005	0.00007	0.00008	0.00011	0.00008	0.00010	
SII TECHNICAL INTEREST	-0.00002	-0.00010	-0.00013	-0.00012	0.00007	-0.00010	
FOR GENDER: MALE = REFERENCE CATEGORY							
FEMALE	**-0.09821**	-0.01844	0.01798	**-0.05646**	0.02334	**-0.07904**	**-0.07790**
FOR RACE/ETHNICITY: WHITE = REFERENCE CATEGORY							
BLACK	**-0.11523**	**-0.20434**	**-0.09842**	**-0.22746**	**-0.11065**	**-0.12269**	**-0.14646**
OTHER	**-0.08950**	**-0.06463**	**-0.05951**	**-0.14807**	-0.02925	**-0.11801**	**-0.09594**
CONSTANT	**2.01370**	**1.87818**	**1.94041**	**2.01663**	**1.61787**	**1.69180**	
ADJUSTED R-SQUARED	**.199**	**.224**	**.152**	**.197**	**.198**	**.190**	**0.193**

Table 24. Cumulative Military QPR Linear Regression Model Results
(Standardized Coefficients)

VARIABLE	1995	1996	1997	1998	1999	2000	AVG SIGNIFICANT VALUES
HIGH MATH SAT	**0.121**	**0.151**	**0.098**	**.109**	**.125**	**0.143**	**0.125**
HIGH VERBAL SAT	**0.073**	0.029	**0.107**	.068	.061	0.008	**0.111**
HIGH SCHOOL CLASS RANK	**0.267**	**0.287**	**0.206**	**.232**	**.293**	**0.251**	**0.256**
COMBINED ECA	0.034	0.045	**0.073**	.009	**.082**	**0.081**	**0.078**
RECOMMENDATIONS	**0.109**	**0.110**	**0.092**	**.083**	.051	**0.091**	**0.097**
SII CAREER INTEREST	0.016	0.025	0.030	.036	.025	0.030	
SII TECHNICAL INTEREST	-0.008	-0.035	-0.045	0.038	.022	-0.028	
FOR GENDER: MALE = REFERENCE CATEGORY							
FEMALE	**-0.109**	-0.022	0.021	**0.068**	.026	**-0.086**	**-0.088**
FOR RACE/ETHNICITY: WHITE = REFERENCE CATEGORY							
BLACK	**-0.100**	**-0.170**	**-0.076**	**0.177**	**0.084**	**-0.088**	**-0.116**
OTHER	**-0.104**	**-0.071**	**-0.061**	**0.162**	0.030	**-0.117**	**-0.103**
CONSTANT							
ADJUSTED R-SQUARED	**.199**	**.224**	**.152**	**.197**	**.198**	**.190**	**0.193**

Note: Bold faced coefficients significant at the .05 level

F. LINEAR REGRESSION MODEL OF ORDER OF MERIT

Table 25 displays the variables from the linear regression model predicting Order of Merit. The six separate regressions were conducted to account for the different formula used for Order of Merit calculations. The removal of the Professional Competency Review Tests resulted in an increase in the value of military performance and conduct in the final Order of Merit calculation.

Eight of the ten independent variables in this model were significant at the .05 or better level.[20] Four of the independent core admissions variables were associated with a lower predicted OOM for at least one class.[21] Based on the standardized coefficients, high school class rank and high math SAT had the greatest predictive effect on OOM, with values averaging -.332 and -.233, respectively. High verbal SAT and recommendations were also inversely related to Order of Merit, but not as strongly. Controlling for other variables, SII technical interest scores were positively related to order of merit but it was not as powerful as the other predictors such as high school class rank.

The demographic variables all had positive relationships with Order of Merit. The coefficient for female midshipmen predicted an average OOM value 60.88 higher than males in the classes of 1995, 1998, and 2000.[22] Similarly, the race variables “black” and “other:” predicted average increases of 116.26 (black) and 97.98 (other) in the OOM compared to the white reference category based on their coefficients.[23] Their average standardized coefficients showed that the demographic variables were between a fourth (female) and a third (black and other) as strong as high school class rank when predicting OOM. The OOM model as a whole explained on average 30.8% of the total variability of the OOM.

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[20] Combined ECA and SII career interest were not significant for any of the classes.

[21] Both high math SAT and high school class rank were significant for all six classes.

[22] The variable “female” was only significant for these three class years.

[23] The variable “black” was significant for all six class years, while “other” was only significant for three.

Table 25. Order of Merit by Class Year Linear Regression Model Results (Unstandardized Coefficients)

VARIABLE	1995	1996	1997	1998	1999	2000	AVG SIGNIFICANT VALUES
HIGH MATH SAT	**-0.995**	**-1.244**	**-0.884**	**-0.959**	**-0.990**	**-1.026**	**-1.01632**
HIGH VERBAL SAT	**-0.317**	**-0.342**	**-0.361**	**-0.236**	**-0.263**	-0.119	**-0.30382**
HIGH SCHOOL CLASS RANK	**-0.732**	**-0.964**	**-0.761**	**-0.779**	**-0.869**	**-0.858**	**-0.82691**
COMBINED ECA	0.170	0.184	0.141	0.164	-0.018	-0.044	
RECOMMENDATIONS	**-0.282**	-0.134	-0.181	**-0.240**	-0.155	**-0.208**	**-0.24313**
SII CAREER INTEREST	0.004	-0.028	-0.070	-0.024	-0.140	-0.013	
SII TECHNICAL INTEREST	**0.225**	**0.177**	**0.215**	**0.215**	0.108	0.136	**0.20801**
FOR GENDER: MALE = REFERENCE CATEGORY							
FEMALE	**79.668**	31.001	-22.419	**48.424**	4.464	**54.542**	**60.87792**
FOR RACE/ETHNICITY: WHITE = REFERENCE CATEGORY							
BLACK	**116.013**	**131.811**	**111.228**	**159.790**	**63.527**	**115.171**	**116.25674**
OTHER	**89.574**	**64.251**	41.604	**140.126**	36.250	41.921	**97.98359**
CONSTANT	1727.617	1978.154	1701.077	1661.193	1887.051	1837.651	
ADJUSTED R-SQUARED	.303	.359	.270	.301	.328	.287	**0.308**

Note: Bold faced coefficients significant at the .05 level

Table 26. Order of Merit by Class Year Linear Regression Model Results (Standardized Coefficients)

VARIABLE	1995	1996	1997	1998	1999	2000	AVG SIGNIFICANT VALUES
HIGH MATH SAT	**0.238**	**0.263**	**0.200**	**0.214**	**0.249**	**0.235**	**-0.233**
HIGH VERBAL SAT	**0.086**	**0.087**	**0.099**	**0.069**	**0.076**	0.030	**-0.083**
HIGH SCHOOL CLASS RANK	**0.299**	**0.378**	**0.312**	**0.311**	**0.355**	**0.336**	**-0.332**
COMBINED ECA	.044	.046	.035	.043	0.005	0.012	
RECOMMENDATIONS	**0.099**	0.042	0.057	**0.073**	0.051	**0.064**	**-0.079**
SII CAREER INTEREST	.001	0.010	0.026	0.009	0.053	0.005	
SII TECHNICAL INTEREST	**.081**	**.061**	**.077**	**.076**	.041	.048	**0.074**
FOR GENDER: MALE = REFERENCE CATEGORY							
FEMALE	**.098**	.037	0.027	**.067**	.006	**.070**	**0.078**
FOR RACE/ETHNICITY: WHITE = REFERENCE CATEGORY							
BLACK	**.111**	**.109**	**.091**	**.143**	**.061**	**.098**	**0.102**
OTHER	**.115**	**.070**	.045	**.176**	.047	.049	**0.121**
CONSTANT							
ADJUSTED R-SQUARED	303	359	270	301	328	287	**0.308**

Note: Bold faced coefficients significant at the .05 level

The major selection and performance models were created to determine if parts of the admissions model, specifically SII technical interest, served as good predictors of a midshipman's major and performance. In the major selection models, SII technical interest had predictive value. In initial major selection, it had the highest predictive value of any of the variables, regardless of the inclusion of demographic variables, although high math SAT was nearly as effective. In predicting final major selection, it was more effective, second only to high math SAT. High school class rank and SII career interest also were significant predictors of technical major, but to a lesser extent.

SII technical interest was not as strong in predicting performance in the models. In the cumulative Military Quality Point Rating model, it was not significant.[24] Although it was significant in the Academic QPR model, it had a negative weight. Each point received on the SII technical interest score resulted in a predicted AQPR .0003 lower. Similarly, in the Order of Merit model, it was significant in four of the class years, but each point on the SII technical interest scale resulted in a decreased Order of Merit of .208 points on average. The best predictors for performance seemed to be high math SAT and high school class rank. Both were associated with a higher predicted MQPR and AQPR and a lower OOM in all six class years.

24 At the .10 significance level.

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V. CONCLUSIONS AND RECOMMENDATIONS

This study focused on assessing the relationship between the Strong Interest Inventory (SII) (and, in particular, Technical Interest) and technical major selection. Additionally, the study analyzed whether the scale had any performance prediction value. The goal of this thesis is to provide the U.S. Naval Academy admissions board with information regarding the validity of the SII for use in the admissions process. More specifically, the relationships between interest scores and major selection and midshipman performance were assessed. The recommendations below address testing methods and how the SII can be applied in the admissions process in the future.

A. CONCLUSIONS REGARDING MAJOR SELECTION

1. Midshipmen Overall

The Strong Interest Inventory was shown to be a valid predictor of technical major selection among midshipmen as a whole. With regard to this academic major criterion, the SII had the highest predictive value of any of the variables in the Candidate Multiple (e.g., SAT scores, high school class rank) in the model. Each point an applicant scored on the technical interest scale increased his/her likelihood of *initially* selecting a technical major by .18%. Findings for final major selection were similar. Each point scored on the technical interest scale increased the likelihood of selecting a final technical major by .19%. Within the Candidate Multiple, technical interest was shown to be the best single predictor of academic major. Career interest had some value as a predictor of academic major, but it had the smallest weight of any of the Candidate Multiple variables in the models. The SII together with the other Candidate Multiple variables accurately predicted 74.6% of initial majors and 72.9% of final majors. These findings are in accord

with the conventional wisdom at the Academy as expressed by the Associate Director of Admissions, Mr. Pantelides.

2. Female Midshipmen

The validity of technical interest for predicting initial and final major held for female midshipmen alone as well as for the total sample (marginal effects of .22% and .18% respectively for initial major selection and .26% and .19% for final major selection). Career interest was shown to be the smallest predictor of major selection among female midshipmen. Although the models were not subjected to statistical comparison, it is notable that the validity of the SII for female midshipmen was on par with, if not stronger, than for midshipmen overall.

These results may be related to a lack of interest in technical (specifically engineering) fields among women relative to men. This assumption is supported by the lower mean SII technical interest among women. Because high technical interest scores are less common among women (relative to men), high scoring women may be more likely to major in a technical field than male midshipmen with comparable scores (all other variables being equal). The SII technical interest score may be particularly valuable in identifying and selecting female applicants who are likely to graduate with a technical major.[25]

3. Black, Male Midshipmen

The SII technical interest score also was successful in predicting technical majors among black, male midshipmen. Each point scored on the technical interest scale

[25] The dummy variable, Female, was significant in the base model. This indicated that, all things equal, women are more likely to select a technical major.

increased the chance of selecting an initial technical major by .20%. The effect of technical interest in the final selection model was not as large as in the initial major selection model. Career Interest was not shown to be significant in the regression equation for black, male midshipmen.

These results support the use of the technical interest score in the Candidate Multiple. The SII was designed to match people to careers whose workers hold similar interest. It seems fitting that the more interest an applicant shows in technical areas prior to admission, the more likely he/she is to major in a technical field. The success of this part of the Candidate Multiple in predicting technical major selection is in line with the Admissions Board's desire to admit students who will graduate with technical degrees.

B. CONCLUSIONS REGARDING PERFORMANCE PREDICTION

1. AQPR

Although technical interest proved significant in the Academic QPR model, scores were inversely related to AQPR. All else equal, each point on the SII technical interest scale predicted a decrease in AQPR by .0003. Although this value may seem small, the predicted AQPR can be as much as .22 lower if the highest possible technical interest score is earned. Career interest was not significant in the AQPR performance regressions.[26]

This relationship may come as no surprise to the designers of the SII. Although the technical scale is predictive of interest in technical fields, interest in a particular area does not mean the student will perform well. Millions of people love football, but few are really good at the game. A possible explanation for the inverse relationship is that

technical majors are more challenging academically and thus associated with lower AQPRs. It is a common perception that the course load of Group I and II majors is more rigorous. Whether this is true or not remains to be demonstrated, but should it prove accurate, it might explain why high technical interest may predict lower AQPR, particularly among technical majors.

2. OOM

SII technical interest predicts poorer performance in terms of Order of Merit. The higher a midshipman's SII technical interest score, the higher their Order of Merit (or lower the class standing).[27] Each point on the SII technical interest scale resulted in an average increase of .208 points on Order of Merit. These results mirror those of the predictive value of technical interest on AQPR. As with AQPR, interest in a technical field does not eliminate the rigor. Also, it is important to keep in mind that a large portion of OOM is determined by AQPR thus influencing these similarities in terms of technical interest predicting lower performance.

3. MQPR

The SII technical interest score showed no bearing on Military QPR. The relationship was not significant in any of the six MQPR class regressions. These results are not inconsistent with those found for AQPR, OOM, or major selection. As mentioned above, the technical interest score was designed to help predict technical major selection. The Military QPR shows performance in military related areas such as

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[26] Career interest was not significant in any of the three performance prediction regressions.

[27] OOM is a ranking of all midshipmen in a class, thus the higher the OOM, the poorer the performer.

professional courses[28], conduct, and military and athletic performance. None of these areas are technical in nature. Therefore, the lack of significance of technical interest in predicting performance in MQPR is not surprising.

C. ISSUES AND RECOMMENDATIONS

This study generally supports the validity of the SII for predicting academic major. However, there remain questions regarding SII administration by and utility for USNA. Following are some recommendations that stem from the present thesis.

1. Standardization

As raised in the background section of this thesis, USNA's administrative procedures for the SII are a concern. The inventory is included in each USNA applicant's packet. It is taken in an unsupervised setting and returned along with the other admissions material. This situation lends itself to criticism and questions arise regarding the reliability and validity of the SII for the Academy. Because every applicant must complete the test to be considered for admissions, response rates are 100% for admitted personnel. Unfortunately, because the test is self-administered and returned with the rest of the application, candidates take the test under different (non-standardized) conditions. Two adverse scenarios are possible in this situation. Students may be coached to respond in a way that portrays a high technical interest in order to better their admission chances or they may try to game the test on their own with the same goal in

[28] None of the professional courses, with the exception of Naval Weapons Systems, are technical in nature.

mind. Standardized conditions would help reduce the likelihood of these actions.[29] The first scenario might be eliminated under standardized conditions, whereas the second might be reduced somewhat. Standardization may result in lower technical interest scores on average, but it would reduce error and reveal true interest in technical fields and be a more valid use of the technical interest scales. Though gaming of the test would most likely still occur, a standardized procedure for administering the SII would improve the validity and legitimacy of the test and help the Academy select the students they desire.

2. Reassessing the Use of the Career Interest Variable

The career interest scale was not shown to be significant in any of the three performance prediction regressions and was the smallest positive predictor of technical major selection for the overall midshipman sample and the sub sample of women.[30] The present “tepid” results coupled with past failures to find significance for career interest as a part of the Candidate Multiple, question its usefulness (McNitt, 1982). Unless subsequent focussed analysis finds practical value for this variable in the admissions process, it should be considered for removal or replacement by a more constructive tool.

3. Predicting Performance or Predicting Major Selection

The results of the study call into question the advisability of using a single Candidate Multiple for USNA admissions decisions. Although positively related to major selection, the regression analyses indicated that SII technical interest either predicts

[29] A possible method of standardizing the administration of the SII is through the Blue and Gold Officers. They could administer the test during their interview and provide guidance on the need to answer the questions honestly.

[30] Career interest was shown to be insignificant in the black, male midshipman regression.

lower performance (lower AQPR and higher OOM) or is not predictive (MQPR) of performance.

Assuming that the Admissions Board seeks to admit students based on both predicted performance and predicted major selection, then it may be advisable to include the SII scores in a separate multiple or to develop more sophisticated algorithms that are able to maximize both goals simultaneously. This way the Candidate Multiple's predictive ability for performance can be increased. If the desire is to admit applicants who will be more likely to major in technical field, regardless of performance, then the current Candidate Multiple formula may provide the service the Admissions Board wants.

In conclusion, this study supports the predictive validity of the SII relative to major selection. Additionally, its inverse or neutral relationship to performance supports the construct validity of the SII as an interest measure vice an academic or cognitive screening tool. Although there are issues with regard to the Naval Academy's use of the SII, the technical interest scales have shown merit. By using the information presented in this thesis and properly addressing the issues and recommendations made within, the U.S. Naval Academy Admissions Board can capitalize on the use of these scales. Through proper application, the Strong Interest Inventory technical interest scale can be used to improve the U.S. Naval Academy's admissions process and help admit applicants who meet the demanding technical needs of the Navy.

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APPENDIX A. PERCENTAGE OF TECHNICAL MAJORS TABLES

Class Year * Initial Major Crosstabulation

			Initial Major		Total
			Non-Technical Major	Technical Major	
Class Year	1995	Count	289	603	892
		% within Class Year	32.4	67.6	100.0
	1996	Count	237	671	908
		% within Class Year	26.1	73.9	100.0
	1997	Count	277	650	927
		% within Class Year	29.9	70.1	100.0
	1998	Count	287	615	902
		% within Class Year	31.8	68.2	100.0
	1999	Count	316	549	865
		% within Class Year	36.5	63.5	100.0
	2000	Count	342	582	924
		% within Class Year	37.0	63.0	100.0
Total		Count	1748	3670	5418
		% within Class Year	32.3	67.7	100.0

APPENDIX A. (CONT.) PERCENTAGE OF TECHNICAL MAJORS TABLES

Class Year * Final Major Crosstabulation

			Final Major		Total
			Non-Technical Major	Technical Major	
Class Year	1995	Count	315	577	892
		% within Class Year	35.3	64.7	100.0
	1996	Count	294	614	908
		% within Class Year	32.4	67.6	100.0
	1997	Count	335	592	927
		% within Class Year	36.1	63.9	100.0
	1998	Count	329	573	902
		% within Class Year	36.5	63.5	100.0
	1999	Count	353	512	865
		% within Class Year	40.8	59.2	100.0
	2000	Count	390	534	924
		% within Class Year	42.2	57.8	100.0
Total		Count	2016	3402	5418
		% within Class Year	37.2	62.8	100.0

Female * Initial Major Crosstabulation

			Initial Major		Total
			Non-Technical Major	Technical Major	
	Male	Count	1479	3213	4692
		%	31.5	68.5	100.0
	Female	Count	269	457	726
		%	37.1	62.9	100.0
Total		Count	1748	3670	5418
		%	32.3	67.7	100.0

APPENDIX A. (CONT.) PERCENTAGE OF TECHNICAL MAJORS TABLES

Female * Final Major Crosstabulation

			Final Major		Total
			Non-Technical Major	Technical Major	
	Male	Count	1701	2991	4692
		%	36.3	63.7	100.0
	Female	Count	315	411	726
		%	43.4	56.6	100.0
Total		Count	2016	3402	5418
		%	37.2	62.8	100.0

Black* Initial Major Crosstabulation

			Initial Major		Total
			Non-Technical Major	Technical Major	
	non-Black	Count	1634	3469	5103
		%	32.0	68.0	100.0
	Black	Count	114	201	315
		%	36.2	63.8	100.0
Total		Count	1748	3670	5418
		%	32.3	67.7	100.0

Black * Final Major Crosstabulation

			Final Major		Total
			Non-Technical Major	Technical Major	
	non-Black	Count	1877	3226	5103
		%	36.8	63.2	100.0
	Black	Count	139	176	315
		%	44.1	55.9	100.0
Total		Count	2016	3402	5418
		%	37.2	62.8	100.0

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APPENDIX B. MEAN VARIABLE VALUES BY GENDER AND RACE

VARIABLE	Overall	Female	Black Male
HIGH MATH SAT	661.88	650.54	597.94
HIGH VERBAL SAT	577.89	588.26	512.89
HIGH SCHOOL CLASS RANK	578.63	613.33	517.65
COMBINED ECA	556.91	568.58	541.12
RECOMMENDATIONS	877.83	891.14	868.01
SII CAREER INTEREST	499.74	475.58	486.17
SII TECHNICAL INTEREST	497.18	449.45	504.28

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APPENDIX C. CORRELATION MATRIX

		High Math SAT	High Verbal SAT	Hs Official St Class Rank	Combined Eca	Recommendations	Career Interest	Technical Interest	Female	Black
High Math SAT	Pearson Correlation	1.000	.410	.312	-.059	.038	.079	.127	-.073	-.271
	Sig. (2-tailed)	.	000	.000	.000	.006	.000	.000	.000	.000
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418
High Verbal SAT	Pearson Correlation	.410	1.000	.261	-.019	.128	-.042	-.147	.054	-.198
	Sig. (2-tailed)	.000	.	.000	.164	.000	.002	.000	.000	.000
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418
Hs Official St Class Rank	Pearson Correlation	.312	.261	1.000	.162	.269	.067	.021	.128	-.123
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.127	.000	.000
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418
Combined Eca	Pearson Correlation	-.059	-.019	.162	1.000	.092	.009	-.186	.067	-.044
	Sig. (2-tailed)	.000	.164	.000	.	.000	.504	.000	.000	.001
	N	5418	5418	5418	548	5418	5418	5418	5418	5418
Recommendations	Pearson Correlation	.038	.128	.269	.092	1.000	.017	-.059	.061	-.023
	Sig. (2-tailed)	.006	.000	.000	.000	.	.203	.000	.000	.089
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418
Career Interest	Pearson Correlation	.079	-.042	.067	.009	.017	1.000	.226	-.098	-.048
	Sig. (2-tailed)	.000	.002	.000	.504	.203		.000	.000	.000
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418
Technical Interest	Pearson Correlation	.127	-.147	.021	-.186	-.059	.226	1.000	-.198	-.006
	Sig. (2-tailed)	.000	.000	.127	.000	.000	.000	.	.000	.681
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418
Female	Pearson Correlation	-.073	.054	.128	.067	.061	-.098	-.198	1.000	.018
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.	.184
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418
Black	Pearson Correlation	-.271	-.198	-.123	-.044	-.023	-.048	-.006	.018	1.000
	Sig. (2-tailed)	.000	.000	.000	.001	.089	.000	.681	.184	.
	N	5418	5418	5418	5418	5418	5418	5418	5418	5418

** Correlation is significant at the 0.01 level (2-tailed).

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